

## Gravatt, Dan

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**From:** Barth, Edwin  
**Sent:** Wednesday, September 18, 2013 11:36 AM  
**To:** Gravatt, Dan  
**Subject:** RE: West Lake Landfill: USGS comments on the SSFS workplans

Dan, I don't recall apatite treatment in my review. Was there a document I should have commented on?

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**From:** Gravatt, Dan  
**Sent:** Wednesday, September 18, 2013 11:30 AM  
**To:** Tapia, Cecilia; Hammerschmidt, Ron; 'Warren, Victoria'; Paul Rosasco; Muenks, Shawn  
**Cc:** Ammon, Doug; Openchowski, Charles; Walker, Stuart; Bartenfelder, David; jschu@usgs.gov; Barth, Edwin  
**Subject:** West Lake Landfill: USGS comments on the SSFS workplans

All, see John's thoughts on the Apatite treatment SFS workplan below and the attached reference.

USGS also provided comments on the fate and transport SFS workplan in the attached Word document.

This represents the complete set of USGS comments on the SSFS workplans. All EPA comments on the SSFS workplans have now been provided.

Sincerely,  
Daniel R. Gravatt, PG  
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Principles and integrity are expensive, but they are among the very few things worth having.

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**From:** Schumacher, John [mailto:jschu@usgs.gov]  
**Sent:** Wednesday, September 18, 2013 8:22 AM  
**To:** Gravatt, Dan  
**Subject:** Apatite treatment SFS

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Dan,

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I read through the apatite SFS and rather than make comments. I thought I'd send you a short note and a reference. While apatite or PO<sub>4</sub> treatment is considered a method to reduce the mobility of metals, including some radionuclides (especially U) from wastes, from a cursory review, it is unclear if the technology will achieve stabilizing radionuclides to such a degree that MCL can be achieved. Mineralogical studies we did of the sediments in the Weldon Spring chemical plant raffinate pits shown much of the U there was associated with apatite (Schumacher, 1993, USGS Open-File report 93-433). Mineral phases identified were mostly gypsum, apatite, sellaite, and even some carnotite and thoranite (probably undigested ore). Interesting that we

saw no barite and Ba concentrations in the solid phase were less than 250 ppm. Data from that report may be helpful to EPA as it is possible that the some of the waste stream from that feed materials plant was not that different from the downtown plant that was the origin of the RIM at West Lake. Perhaps it better than nothing. Maybe DOE did additional characterization of the solids before the cleanup was done.

In the following paper, phosphate mineral samples from Florida, known for their radionuclide contents, were subjected to laboratory leaching studies. It is interesting that more "weathered" mineral grains tended to leach the largest amounts of radionuclides (no big surprise), and that a fair amount of the radium contained in the mineral grains was leached even at high pH. So while, pretty insoluble, it looks as if radionuclides can be leached from crystalline PO<sub>4</sub> minerals within the two week time frame of the Florida study. Given the very small Ra-226 concentration at the MCL of 5 pCi/L (about 5x10<sup>-6</sup> ug/L), any amount that is leachable probably would generate a solution concentration above MCL. I think the FT SFS work plan indicated that landfill leachate pH is likely to increase with time as the landfill ages and thus decreasing Ra mobility; however, things obviously are not that simple.

cheers,

John

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